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ABSTRACT

Using the Kalamazoo Brothers' data and the Project Talent 11-year Follow-up survey, the authors tested six propositions implied by the meritocratic model of socioeconomic achievement and found the following: (1) the influence of family background on educational attainment, occupational status, and earnings has not fallen over time, nor has the effect of measured cognitive ability risen; (2) the principal impact of so-called meritocratic criteria (i.e., tested ability) is to connect men to their backgrounds, rather than to free them, while the effects of background are mediated principally by factors other than ability; (3) measured ability does affect adult standing, but socioeconomic success is determined principally by factors unrelated to cognitive ability; (4) superior ability does not function as a necessary prerequisite for desirable jobs; (5) the effects of education on occupational status and earnings cannot readily be explained by the relationship between education and measured ability; and (6) men with high test scores do not benefit from additional education more than men with low test scores, suggesting that the exclusion of low ability individuals from higher education cannot be justified on grounds of economic efficiency. (Author/EB)

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MYTHS OF THE MERITOCRACY: COGNITIVE SKILL AND ADULT SUCCESS IN THE UNITED STATES

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Myths of the Meritocracy: Cognitive Skill and Adult Success in the United States

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ABSTRACT

Using the Kalamazoo Brothers data and the Project Talent 11-year Follow-up survey, the authors tested six propositions implied by the meritocratic model of socioeconomic achievement and found the following results:

1. The influence of family background on educational attainment, occupational status, and earnings has not fallen over time, nor has the effect of measured cognitive ability risen.

2. The principal impact of so-called meritocratic criteria (i.e., tested ability) is to connect men to their backgrounds, rather than to free them. The effects of background are, however, mediated principally by factors other than ability.

3. Measured ability does affect adult standing, but socioeconomic success is determined principally by factors unrelated to cognitive ability.

4. Superior ability does not function as a necessary prerequisite for desirable jobs.

5. The effects of education on occupational status and earnings cannot readily be explained by the relationship between education and measured ability.

6. Men with high test scores do not benefit from additional education by more than men with low test scores, suggesting that the exclusion of low ability individuals from higher education cannot be justified on grounds of economic efficiency.

Myths of the Meritocracy: Cognitive Skill and Adult Success in the United States

1. INTRODUCTION

The Darwinian doctrine of "survival of the fittest" profoundly influenced early American psychology. The perception of dog-eat-dog competition in nature was extended to human society. Thus the plight of the poor after Darwin was often portrayed as selection against persons least fit to survive. Social position and wealth that resulted from successful competition were commonly identified with intellectual merit. It was natural in this context for psychologists to attempt to identify individuals with the greatest productive potential. To this end, testing pioneers pursued the objective measurement of intelligence.[1]

From the outset, the use of intelligence tests provoked controversy. Testing pioneers aggressively promoted their instruments for selection in the military, education, and private occupations, although the intelligence tests were sometimes criticized as biased and unfair to minorities. Their research was often funded by large, private foundations with close ties to corporate industry. They actively participated in the eugenics and immigration restriction movements, tying empirical research results to a hereditarian bias in efforts to pursuade government to rid the population of defectives and undesirables.[2] The role of researchers in the eugenics and immigration restriction movements prompted some commentators to rebuttals reminiscent of contemporary critiques of racial unfairness in test instruments.[3] More recently, the work of

psychologists on the malleability of intelligence has contributed to controversy about the comparative merits of early or later educational intervention;[4] and Arthur Jensen (1968) used his argument that intelligence is genetically determined as an explanation for the dismal results of compensatory education.

Given the close relationship between this research and political controversies, it is somewhat puzzling to us that psychologists have not spent more effort trying to determine whether "intelligence," or whatever IQ and standardized group tests measure, is in fact an empirically important human characteristic. Some studies by psychologists have related test scores to school grades or length of eventual schooling, and some have considered the relationship of test scores to occupational prestige, but compared to other endeavors these are quite limited.[5] Instead, psychologists appear to share with laymen some common beliefs about the social and economic value of "IQ." Like others they appear to believe that technological changes have placed a premium on cognitive advantage, thus generating a substantial and increasing effect of individual IQ on economic success; and that there has been a corresponding decline in the effect of ascriptive characteristics, except, of course, to the extent that intelligence depends upon biologically or socially inherited factors. The expectation of an increasingly meritocratic social system is probably nowhere better expressed than in Richard Herrnstein's tract, I.Q. in the Meritocracy (1971):

> For intelligence tests, and the related aptitude tests, have more and more become society's instrument for the selection of human resources. Not only for the military, but for schools

> from secondary to professional, for industry, and for civil service, objective tests have eroded the traditional grounds for selection—family, social class, and, most important, money. The traditional grounds are, of course, not entirely gone, and some social critics wonder if they do not lurk surreptitiously behind the scenes in our definition of mental ability . . . But at least on the face of it, there is a powerful trend toward meritocracy--the advancement of people on the basis of ability, either potential or fulfilled, measured objectively.

Additionally, psychologists and laymen seem to accept direct or indirect selection on the basis of IQ as efficient and rational. There is, of course, disagreement over what constitutes fair use of tests for selection. Courts, with the help of psychologists and others, are now trying to decide when unconstitutional discrimination results from racially and culturally biased tests. But there is little doubt that some form of selection by ability receives widespread acceptance. Herrnstein takes this stand explicitly:

> The ties among IQ, occupation, and social standing make practical sense. The intellectual demands of engineering, for example, exceed those of ditch digging. Hence, engineers are brighter, on the average. If virtually anyone is smart enough to be a ditch digger, and only half the people are smart enough to be engineers, then society is, in effect, husbanding its intellectual resources by holding engineers in greater esteem, and on the average, paying them more . . .

By directing its approval, admiration, and money towards certain occupations, society promotes their desirability, and hence, competition for them. To the extent that high intelligence confers a competitive advantage, society thereby expresses its recognition, however imprecise, of the importance and scarcity of intellectual ability.

We are convinced that the suppositions embodied in the meritocratic model are substantially wrong. Our purpose here is to convince psychologists and others that the United States is hardly an "I.Q." meritocracy, and that those who spend enormous energies trying to understand I.Q. are analyzing a characteristic of only modest economic importance. To this end, we have tested six propositions concerning relationships among measures of family background, test scores, educational attainment, occupational status, and earnings, for which we would expect to find empirical support if the meritocratic model were correct. The propositions and results are as follows:

1. The influence of family background on educational attainment and economic success should have declined over time, whereas the effects of the characteristics measured by test scores should have risen. Our data do not suggest that this is the case.

2. The effects of "ability" should substantially sever the connections between background and later position. To the extent that background does affect later position, it should do so principally by affecting ability. Neither seems to be true.

3. Adult standing should be substantially determined by cognitive ability. Although cognitive skills do pay off, variations in educational

attainment, occupational status, and earnings far exceed the range of differences expected on the basis of cognitive differences alone.

4. Superior cognitive ability should be a necessary (although possibly insufficient) prerequisite to entering higher level jobs. We should expect to find men with lower scores concentrated in poor jobs; whereas men with higher scores should be found in more diverse jobs, either because there are fewer prestigious jobs than men intellectually qualified for them, or because characteristics in addition to intellectual ability are required for successful performance in these jobs. We would also expect to find a more limited range of cognitive ability represented in high status occupations than in low. Our best evidence does not support these expectations.

5. Educational attainment should affect occupational status and earnings mainly because it reflects cognitive ability. We should find that socioeconomic returns to additional schooling among individuals with similar test scores are substantially lower than among individuals in general. We do not. Post-secondary education, especially, continues to pay off even when it does not reflect measured cognitive differences.

6. We should find evidence that society's investment in the more able is optimal and socially efficient. If education is partly an economic investment, and if the private returns to schooling index the contribution of the better schooled to the national product, we should find that percentage increments in monetary returns to additional schooling are greater for individuals with higher test scores than for those with lower scores.[7] We do not. Men with low test scores appear to realize benefits to additional schooling that are similar to those for men with

high test scores. This suggests that the exclusion of the less able must be justified on grounds other than an economically rational allocation of human resources.

Despite the currency of these issues, the data with which they have been addressed previously have been extraordinarily limited. For example, Herrnstein's analysis is the most thorough we have found by a psychologist. His chapter on the uses of intelligence cites over 25 primary and secondary sources, but none includes a representative American sample of respondents having information on all relevant variables. Jencks and his co-authors (1972) had better data, but were forced to rely principally on only two data sets to assess the continuing effects of cognitive skills: the 1964 National Opinion Research Center survey of veterans, and the 1964 follow-up of 1957 Wisconsin high school seniors.[8] The respondents in both samples were relatively young when they were surveyed, and because of military selection procedures and educational attrition, cannot be presumed to be representative. Economists attempting to examine the confounding influence of ability on estimates on the effects of schooling have also had to rely on the Veteran's sample, or on even less representative samples.[9]

We have not remedied the data base problem in this field, but our data are in some ways richer than those previously relied upon. Our analyses rely upon two new samples of American men. In the Project Talent 11-Year Follow-up of 1960 high school juniors, we have a national sample of men who took a battery of 64 tests and responded to an extensive questionnaire when they were in high school. They were resurveyed 11 years later when they were approximately 28 years old, in

1972. The Talent data permit us to investigate the impact of many cognitive skills on economic success for a representative sample of young men who had reached the junior year of high school. We also have comparable information for a subsample of Talent brothers who were in 11th or 12th grade at the time of the original Talent survey. Our information on brothers allows us to more fully hold constant those aspects of family background that influence both test scores and economic success than would be possible if we relied solely on explicit measures of socioeconomic origins.

In the Kalamazoo Brothers sample, we have the only American data that include information on both early ability and adult success for a sample of middle-aged men with close to the full range of test scores. This sample is also one of the very few reasonably large data sets that includes information on more than one son in each family.[10] Consequently, like the Project Talent subsample of siblings, the Kalamazoo sample allows us to control all aspects of background that brothers share, including those that are unmeasured.

In this study, we describe the two principal samples upon which we rely, then consider the question of which tests best measure economically relevant characteristics, and, finally, evaluate the propositions suggested to us by the meritocratic model. Because our intention is to acquaint psychologists and others with the broad outlines of our findings, we have not reported our results in detailed tabular form. Readers who wish more detail should consult Crouse (1977a, 1977b), Crouse and Mueser (in progress), and Olneck (1976a, 1976b, 1977a, 1977b, 1977c).

2. DATA SOURCES

The original Project Talent sample consisted of all students in grades 9 through 12 in a stratified random sample of 1,063 high schools and associated junior high schools in the United States. These schools comprised approximately 5 percent of all such schools in the United States. All but 76 of the schools participated in Talent's testing and questionnaire administration in the Spring of 1960. Data were collected for approximately 400,000 students, of whom 92,272 were juniors.

In 1972, a follow-up questionnaire was mailed to 91,602 of the sample's original juniors. About one-fourth of those followed up returned the questionnaire. In addition, Talent intensively followed up 3.57 percent of the nonrespondents, and achieved an 83 percent return rate among them. Our sample consists of a random 3.61 percent sampling of those who initially returned the questionnaire, and the entire special intensive follow-up sample.

We have analyzed only civilian, noninstitutional males, not in school over half time in 1972, who reported positive earnings, and who had complete data on a rather extensive list of variables measuring family background, cognitive skills, grades, occupational plans, eventual schooling, years of work experience, occupational status, and earnings. The number of such respondents is 839. In addition, we have analyzed 99 pairs of nontwin brothers in which one brother was a junior in 1960 and the other was either a junior or senior.

Talent administered 64 different tests. Crouse (1977a) relied principally on Talent's Academic Composite. This measure is the weighted sum of a respondent's score on tests of vocabulary, English, reading comprehension, creativity, abstract reasoning, and mathematics. As the analyses we first report below indicate, the Academic Composite captures virtually all of the variance in later economic success that can be traced to measures of cognitive skill. Using the Talent norms for all eleventh grade males, we have internally standardized the Academic Composite's mean to 100 and its standard deviation to 15.

The original Kalamazoo Brothers sample consisted of 2,782 males who attended the Kalamazoo public schools between 1928 and 1950.[11] Olneck used school census and enrollment records to identify these individuals as brothers drawn from 1,224 families. He then traced 1,612 respondents and successfully interviewed 1,243 of them during 1973 and 1974. For some analyses, we relied on the data for these interviewees. For other analyses, we relied on a subsample of 346 pairs of bothers (692 individuals) who had been interviewed and had provided complete data on all variables of interest. Despite a high attrition rate, the sample appears to be representative of most relationships of interest for which independent data are available (Olneck, 1976a, 1977b, 1977c). The sample is somewhat advantaged on measures of socioeconomic background and adult success. This stems from the characteristics of Kalamazoo and a modest success bias among respondents. The respondents range in age from 35 to 59 years old.

Our measure of cognitive skill in the Kalamazoo sample comes from tests administered to sixth graders. From 1928 to 1943, the Kalamazoo school system administered the Terman group test to sixth graders, and after 1943, it administered the Otis. Both tests are interpreted as measures of general ability or brightness (Buros, 1965, 1975). The Otis has historically been scaled to a lower mean than the Terman (Ratcliff, 1934), but the variances, reported reliabilities, and correlations with other variables are comparable (Olneck, 1977b; Miller, 1924; Flemming, 1925; Cattell, 1930; Ratcliff, 1934; Buros, 1965). Consequently, after taking into account the effects on test scores of secular trends in father's education, mother's education, father's occupation, and family size, Olneck (1977b) adjusted the Otis scores, and combined the respondents regardless of which test they had taken. The mean of the resulting measure is 100 and the standard deviation is 15.

3. WHICH COGNITIVE SKILLS "PAY OFF"?

The current interest in competence-based education suggests that the public is increasingly worried about how well the nation's schools are succeeding. Educators' opinions differ, however, over what kinds of competencies to stress. Some would favor stressing traditional scholastic materials in a back-to-the-basics approach. Others would favor stressing discrete and practically oriented skills. We tried to identify the outcomes of schooling the Talent tests measure that matter most for how much schooling a man eventually gets, the status of the occupation he will hold around the age of 28, and his earnings.

To do this, we examined the correlation of 30 Talent tests with educational attainment, occupational status, and hourly earnings.[12] We looked first at tests from specific subject areas. After taking differential test reliabilities into account, we found that information in nonacademic areas predicts later success just about as well as information in academic areas.[13] This suggests that academic facts are valuable, but not differentially so compared to nonacademic content. Alternatively, it suggests that facts per se are of little value, and that individuals who absorb and master facts irrespective of content area are at a later advantage.

We next checked the correlations of tests measuring certain skills with predicted success.[14] Tests of reading comprehension and abstract reasoning correlated as highly with education, occupational status, and earnings as did any of the information tests. But tests of other skills, such as table reading, clerical checking, object inspection, sentence memory, and word memory showed little relationship to later success.[15]

We turned next to the problem of conceptualizing the underlying traits measured by all 30 of these tests. Our approach to classifying the underlying dimensions that have economic value is considerably simpler than approaches typically used by psychologists to map the structure of intellect.[16] We identified four domains: academic ability, verbal ability, quantitative ability, and rote memory. We identified tests that appeared to cover each domain and used the first principal component derived from each set of tests as an index of the skills measured by each domain.[17] The usefulness of our indices depends on how much of the variance each one explains in its respective tests. Since the principal components explain 80-95 percent

of the true variance in their component tests, we concluded that the four indices adequately capture the common skills measured by the tests from each domain.

The important question, however, is how well our measures of academic ability, verbal ability, quantitative ability, and rote memory capture the economically valuable characteristics measured by all of the tests. Academic ability predicts adult success almost as well as all 30 individual tests taken together.[18] Academic ability explains between 89 and 92 percent of the variance in each outcome that can be explained by all 30 individual tests taken together. No individual test predicts success as well as academic ability. Verbal and quantitative ability predict success quite similarly, and only slightly less accurately than academic ability. Rote memory does not relate highly to any of the measures of adult success. This suggests that rote memory is of little educational or economic importance, and that critics who claim that mere memorization is highly valued by schools are wrong.[19]

Academic, verbal, and quantitative ability have average intercorrelations of 0.915. This suggests that they proxy similar skills. These are also the skills that matter most for economic success. In general, tests that do not correlate well with these ability measures do not correlate well with each other. They also predict economic success less well, and appear to measure traits in which schools take little formal interest, such as clerical checking and table reading.

We cannot specify precisely what these economically valuable cognitive skills are. They appear to underly aptitude for both verbal and quantitative tasks. Because the tests given in sixth grade in the Kalamazoo

sample predict educational attainment and occupational status as well as academic ability measured in the eleventh grade predicts them in the Talent sample, we suspect that the effects of academic ability derive from characteristics that are stable at least from late elementary through high school.[20] Our suspicion on this score is strengthened by Jencks and Brown's findings (1974) that changes between ninth and twelfth grade scores on Talent's academic composite did not affect eventual educational attainment. These abilities may be stable into adulthood as well. Comparisons of elementary school and eleventh grade test scores with educational and occupational attainment in the Kalamazoo and Talent samples compares favorably with adult test score correlations with the same measures in adult samples (Crouse, 1977a).

The skills seemingly called for on our tests measuring academic, quantitative, and verbal ability include manipulation of symbols and concepts, the capacity to reason abstractly and solve problems, general mental adaptability, and the ability to educe relationships. These skills are what most people think of as "IQ." Our results suggest that those who are interested in seeing schools advance cognitive skills that enhance the economic prospects of students should advocate measures that boost IQ. If our conclusion is correct, efforts which boost specific skills but which do not at the same time boost IQ, are unlikely to have the consequences anticipated by educators and policy makers.

4. EVALUATION OF MERITOCRATIC MODEL

Trends in the Relative Influence of Family Background and Cognitive Skills

If an IQ meritocracy were in the making, we should expect to find the relationships between test scores and measures of adult success rising

over time, and the relationships between family background and adult success falling. We find neither.

Ideally, we would like to have information on test scores, family background, and adult success for different cohorts of respondents at comparable ages. We do not, but because completion of education is a one-time event in the life-cycle, because our evidence does not suggest that test scores bear a differing relationship to later occupational status than to early occupational status, and because the relationship between test scores and earnings appears to stabilize by the time men are in their mid-thirties, we can compare Kalamazoo respondents of varying ages at one point in time to assess historical changes in the effects of cognitive skills.

The correlations between test scores and educational attainment, occupational status, and earnings do not differ significantly among men 35 to 39, 40 to 44, 45 to 50* and 50 to 54. Nor is there any consistent interpretable pattern in the correlations suggesting that larger samples might show a trend where ours did not. Only the correlation between occupational status and test score falls monotonically with age group, but not significantly so.[21]

Comparisons of simple correlations can be misleading, however, since apparent similarities may mask differences in causal relationships. We therefore looked at the standardized regression coefficients for the test score variable in equations predicting educational attainment and earnings, with measures of socioeconomic background controlled. The coefficients are quite similar for men under 45 and for men 45 and over.[22] The standardized effect of test scores on occupational

*A programming error included 50 year-olds in two cohorts.

status is 0.436 for the younger men compared to only 0.361 for the older men, which does suggest some support for the presumed trend. However, the unstandardized coefficients do not differ significantly.

There is little independent evidence against which to test our conclusion that men with cognitive advantages have not become increasingly favored in achieving educational and economic success. Taubman and Wales (1972) juxtaposed the results of a number of local studies, and concluded that college entrance in the 1950s among high school graduates came to depend more on test scores than earlier. But, if high school graduation had become less selective, greater selectivity among graduates for college entrance could occur without greatly affecting the correlation between eventual attainment and test scores. Since the effects of test scores on high school and college completion are unknown in the samples Taubman and Wales examined we cannot test this possibility directly in their data. It is, however, the case in our own data.[23] We know of no data set of respondents who were tested as youngsters to which we might compare our results regarding trends in the relationship of test scores to occupational status and earnings.

Our own evidence with respect to the effects of family background shows no loosening of the ties between origins and attainments. Indeed, for each measure of adult success we examined, measures of father's education, father's occupation, family intactness, and family size explained more variance among Kalamazoo respondents under 45 than among those 45 and over.[24]

Recent analysis of new nationally representative data does, however, suggest appreciable declines over time in the effects of race, region of birth,

and farm origin on educational attainment (Hauser and Featherman, 1976: 109). Since the Kalamazoo respondents are virtually all white and nonfarm origin, and grew up in the same city, these changes would not be reflected in our data. In the case of race, nondiscrimination is no doubt a factor. But the decline in effects of regional differences may be best understood as the effects of development rather than the advance of meritocratic selection processes, and the decline in the effects of farm background probably reflects the disappearance of small, marginal farms rather than the newfound success of farm children in completing school. These same national data also show that the correlation between brothers' educational attainments has barely fallen over time, suggesting that the influence of family background broadly defined has remained stable.[25]

Comparison of the effects of measured background variables on occupational status and earnings in 1961 and 1972 also shows some modest declines (see Corcoran and Jencks, 1977; Jencks, 1977b), but it is questionable whether, with the exception of race, the changes represent progress toward meritocracy rather than greater national uniformity and changes in the distributions of background characteristics. We believe, for example, the former is involved in changes in the effects of Southern background. We remain convinced that apart from evidence that racial discrimination is reduced from previous levels, there is no evidence to suggest that within an individual's frame of educational and employment reference, cognitive advantages have become more salient, and background advantages less salient.[26]

The Role of Cognitive Skill in Transmitting the Effects of Background

Meritocratic criteria of advancement are presumed to reflect achievement rather than ascriptive criteria. "Ability" is therefore counterposed to "family," and is expected to replace the latter as a significant influence in a meritocratic achievement process. Duncan (1968), for example, stressed the "independent" role of ability in furthering socioeconomic success. The term "independent" carries two meanings, however. The first refers to the magnitude of the effect of one variable when others are held constant. So, for example, if the correlation between IQ and years of schooling was 0.55, and the standardized regression coefficient (beta) was 0.45 when measures of socioeconomic origin were controlled, we would say that .45/.55 = 82 percent of the apparent effect of IQ on schooling was "independent" of socioeconomic background. Following the conventions of path analysis, we would say that $(.45)^2 = 20$ percent of the variance in educational attainment was due to the independent contribution of IQ.[27]

But the effects of variables whose magnitudes are independent of background in this first sense may nevertheless contribute to intergenerational status inheritance. This is because the variable of interest, say IQ, may depend on family background. If family background substantially affects IQ, IQ will mainly boost the economic chances of families. If family background has small effects on IQ, IQ will be determined mostly by nonfamilial causes, and will differentiate the economic chances of individuals within families.

The precise extent to which differences in cognitive ability transmit background rather than sever the connections between outcomes and background, is measured by the proportion of variance in ability that depends upon the effects of background. For example, in the Kalamazoo sample family background explains 47 percent of the variance in test scores. Therefore, 47 percent of the effect of test scores (i.e., beta) "transmits" background.[28] In the Talent sibling sample, the analogous figure is 58 percent. If family background did not influence measured ability in the Kalamazoo sample, the covariance between any outcome and test scores due to the independent effects of ability would fall by 47 percent, as would, assuming the earlier relationship between background and test scores was genuinely causal, the variance in test scores, but the new estimates of the standardized effects of test scores would fall by less because the variance in outcomes would also change. The overall correlations between outcomes and test scores would fall by substantially more than the causal effects since they are inflated by the joint dependence of outcomes and ability on background.

For example, in the Kalamazoo sample, the correlation between test scores and early occupational status is 0.445. The standardized regression coefficient controlling brothers' common background is 0.225. Of the 0.225, 0.106 "transmits" background, whereas 0.119 differentiates brothers' statuses.[29] But as noted above, because eliminating the effects of family background on ability would also result in changes in the variances of outcome variables, we cannot just subtract 0.106 from 0.225 to derive the expected coefficient for test scores if ability varied only within families. Rather if background had no effect on ability, we would expect the resulting standardized effect of test scores on early status

to be 0.175. Thus beta would have fallen by 1-(.175/.225)=22.2 percent whereas the overall correlation would have fallen by 1-(.175/.445)=60.7 percent. We found that in both our samples, if family background did not influence measured ability, the expected standardized regression coefficients for test scores for all outcomes would be from 73 to 85 percent as large as they are now. Expected correlations would be only from 39 to 72 percent as large as they are now.[30] These results mean that the relationships among test scores and adult outcomes are hardly independent of family background. Rather, the largest fraction of most correlation reflects the transmission of background influences.

But we have defined family background here rather broadly, to include all the consequences of being raised in one family rather than another which brothers share. If we restrict our meaning of background to only those influences associated with conventionally measured socioeconomic characteristics, such as parental education, paternal occupation, and family size, our conclusions are quite different. These measures of background explain only 13 percent of the variance in test scores in the Kalamazoo sample and 15 percent in the Talent sample. Therefore, only about one-seventh of each estimated effect of measured ability (i.e., beta) may be said to "transmit" socioeconomic-background, and only about one-fifth to one-third of each overall correlation derives from effects associated with socioeconomic background. These results are consistent with the contention that measured ability severs the connections between adult status and family origins. But since measured socioeconomic background represents only a minor fraction of the influence of family membership, we emphasize our earlier results, which show that ability connects men to their origins more than it frees them.

The meaning of these results in the context of the debate over equality of opportunity is unclear. Proponents of the meritocratic ideal will note that test scores do not function principally to transmit strictly socioeconomic influences, and will probably argue that our evidence merely suggests that brothers who are similarly able are, to some extent, similarly successful. But the same could be said if ability had been found to depend largely upon socioeconomic background. Why should the consequences of accidents of birth within socioeconomic strata be any more acceptable than those occurring between strata? If it is unfair that a child is born to a laborer rather than to a banker, why is it not similarly unfair that a child is born to a family conducive to high IQ rather than to a family not conducive to high IQ?

If pursued, this line of reasoning leads to the argument that we generally find more acceptable those consequences that are due to an individual's own control or effort, and less acceptable those due to no fault or action of his own. But we cannot identify those components of ability differences that arise from individuals' own efforts. Even within families, siblings may be treated differently or may encounter fortuitous differential advantages. The results of these are no more deserved, we would argue, than are the results of being born in one social class rather than another. If we object to the consequences of differential class origins, then we must logically object to the consequences of all accidents of birth, or we must object, on grounds other than their consequences, to the mere existence of socioeconomic disparities. On this latter view, an argument for equality of opportunity for children reduces to an argument for equality among adults.

Even if test scores largely transmit background influences, they are nevertheless not the major mechanism by which background affects later success. This is not a paradox. Although test score differences depend substantially on background differences, and ability affects adult outcomes, other kinds of differences between families are more important sources of variation in attainment and success. Families confer advantages and disadvantages, but these are not substantially in the form of greater or lesser cognitive levels. The influence of family background on educational attainment, occupational status, and earnings would be from 60 to 70 percent as large as it is now even if measured cognitive skills had no effects whatsoever, or if such skills were unrelated to background.[31] If background influenced later success only by affecting cognitive skills, as the meritocratic model would suggest, its impact would be only from 15 to 25 percent of its present magnitude.[32] These results mean that families influence their children's later success in ways that have very little to do with success on tests of cognitive ability. The influences of strictly socioeconomic aspects of background are, however, mediated to a greater extent by the effects of cognitive skills than are the influences of overall background. But except for the effects of family size the direct effects of socioeconomic background largely persist even when test scores are controlled.[33]

The Dependence of Socioeconomic Success on Cognitive Skill

Since people overestimate how much the importance of cognitive advantages has changed over time, we think it probable that they also overestimate how important such skills are at any one time. We do not

have any direct evidence on people's precise beliefs about the importance of cognitive skills, or even on what they mean by important.[34] We considered two possible meanings of "important" in this context.

The first is that a large fraction of inequality in educational credentials, occupational status, and earnings is attributed to the consequences of differences in cognitive skills. Under this view, men with similar test scores are presumed to achieve similar levels of success, and men with substantially different test scores are presumed unlikely to achieve equal levels of attainment. Although other systematic sources of unequal positions operate, they are presumed to contribute relatively little to inequality in outcomes.

A second view argues only that the average differences in economic success between men with varying test scores are large. Under this view, factors other than cognitive skills may account for most of the variation in individual achievement, but cognitive advantages are nevertheless valuable. Our evidence is more consistent with this second view than the first. Our results suggest that differences in individual educational attainment, occupational status, and earnings are related largely to factors other than cognitive skills.

If we could eliminate all the differences in measured adult success that are attributable to differences in measured cognitive skill, we would expect to find the dispersion in educational attainment 80 to 85 percent as large as it is now, the dispersion in occupational status 90 percent as large as it is now, and the dispersion in earnings close to 95 percent as large as it is now.[35] Unless other changes ensued, a world in which all had equal cognitive skills would not be a world in which adult standing was perceptibly more equal.

Men with higher test scores are, nevertheless, typically somewhat more successful than men with lower scores. But men with higher test scores are also more likely to possess other advantages that enhance both test score performance and later success. Therefore, test scores will correlate with measures of success even if cognitive skills have no actual effects. Consequently, the value of improved cognitive skills is best estimated by the effects of test scores among men from similar backgrounds.

We compared the effects of differences in cognitive skills among men in general, among men with similar socioeconomic backgrounds, and among brothers.[36] We found, with one exception, that significant proportions of the apparent effects of ability differences are spurious. Men with higher test scores get more schooling and work in higher status occupations in significant measure because they come from families that somehow influence both test score performance and educational persistence, or test score performance and occupational success. We are less certain that this is true for earnings.

In the Kalamazoo sample, we would expect an individual with a 15 point test score advantage to enjoy a 1.6 year advantage in educational attainment. But, we would expect two brothers who differed by 15 points to differ by only 0.9 years on schooling. The analogous results for the Talent sibling sample are 1.6 and 1.06 years. For occupational status, a 15 point test score advantage produces an expected 10.5 point advantage on Duncan status scores in the Kalamazoo sample. But among brothers, such an advantage only produces a 6.7 point occupational advantage. The analogous results among Talent sibling are 12.4 and 7.6 points.

Our results with respect to earnings are mixed. The Kalamazoo results suggest that the observed relationships between test scores and earnings is quite close to the relationship with family background controlled. The Talent results suggest otherwise. In the Kalamazoo sample, a 15 point test score advantage is associated with an expected advantage for 1973 earnings of $2,742. Among brothers, the same test score differential is associated with a $2,604 differential. In the Talent sample, the analogous results are $1360 and $980 for 1972 reported earnings.

There are several possible explanations for the discrepancy between these findings. One is sampling error. The Talent results are in the expected direction, and the Kalamazoo results may simply be anomalous. However, because the Kalamazoo sample is far larger than the Talent sibling sample, and because the Kalamazoo respondents are older, and the effects of test scores on earnings rise with age, it is difficult to accept the Talent results and discount completely the Kalamazoo results. Second, the Kalamazoo results may reflect the possibility that unmeasured aspects of family background affecting test scores differ substantially from those that determine earnings. If this were true, controlling family background when estimating the effects of test scores would be unnecessary. Third, test scores may proxy multiple abilities, some of which are relevant for earnings and others which are not. If test score differences among brothers reflect earnings-related abilities more than differences among unrelated individuals do, controlling family background would raise the apparent effect of test scores. Fourth, test score advantages may be relative, and any given advantage within

families may be more salient in its effects than the same advantage between two unrelated individuals. This could happen if parents respond to given differences in their offspring more than the world at large does to the same differences among unrelated individuals.[37] Our data do not enable us to distinguish among these possibilities. We are tempted to favor sampling error, since the other explanations seem to imply a robust effect of test scores on occupational status as well as on earnings. But the effects of family background and test scores on occupational status are largely mediated by education, whereas those on earnings are not. Consequently, omitting education as we have in these analyses, we would not necessarily expect similar explanations for the effects of test scores on occupational status and earnings. Only larger, more representative bodies of data can determine whether the Kalamazoo result is indeed anomalous.[38]

Our findings suggest that the effects of cognitive skills on individual achievement are quite modest. Educational attainment, occupational status, and earnings depend overwhelmingly upon influences unrelated to test scores. The apparent educational and occupational advantages due to greater cognitive skill are in significant measure spurious. Earnings advantages may be more persistent.[39]

Cognitive Ability as a Necessary But Insufficient Prerequisite for Success

Herrnstein has argued that high status occupations necessarily require individuals with high test scores, but that high scores alone are no guarantee of success (1971, pp. 118-124). If this view were correct, we would expect that the spread in test scores would be low for high status occupations, but that low status occupations would draw from a wide range

of ability levels. Herrnstein cites studies of large numbers of World War II recruits consistent with this expectation. We would also expect to find low scoring individuals concentrated in low status occupations, whereas high scoring individuals would be distributed across a wider range of occupations. Our evidence is not consistent with either of these expectations.

In the Kalamazoo sample, which is our only sample sufficiently large to usefully disaggregate, the dispersion of test scores tends to be greater in high status occupations than in low.[40] This means that while men with quite high test scores would rarely be found in undesirable jobs, men with low scores are represented in desirable jobs in fair numbers.[41] The standard deviation of occupational status for men in low test score brackets is quite similar to that for men in high brackets.[42]

These results suggest that the association between measured ability and occupational status arises from processes quite different from those suggested by Herrnstein. Rather than high cognitive ability being essential for successful performance in desirable jobs, it appears that the capacity to succeed in such jobs is rather widespread, and is not confined to men who score well on tests. Men who score well are favored to some extent in selection for good jobs, but they do not monopolize them. Less desirable jobs, however, draw from a narrower range of cognitive ability. We suspect that the preponderance of low ability men and the relative absence of high ability men in less desirable jobs contributes to the perception that more desirable jobs are staffed exclusively by more able men. Such perceptions may help sustain the legitimacy of significant income differences across occupational lines.

Since our results are discrepant from those which Herrnstein reports, we tried to determine the sources of difference. Herrnstein relied on very large studies of World War II recruits (Harrell and Harrell, 1945; Stewart, 1947), which do show the range of test scores quite restricted in very high status occupations at least insofar as status is equated with median test scores (See Note 40). Since the sample sizes in these studies are in the tens of thousands, permitting more detailed disaggregations, we are uneasy about accepting our own results as more representative. Our unease is accentuated by the possibility that low scorers in the Kalamazoo sample are atypically successful and do not adequately represent the low range of ability. Samples of recruits at a time of mass mobilization may well be more representative of the general population.

On the other hand, the military samples are not ideal either. Recruits tend to be young, and the relationship between test scores and prior civilian job may not be a good guide to the relationship between test scores and later occupation. Indeed, when we examined the relationship between test scores and respondent's first full-time civilian occupation after completion of schooling, rather than between test scores and current occupation, our results were more in accord with those Herrnstein reports. Less desirable first jobs tended to draw men from a wider range of test scores than did similar current jobs, and very high scorers were found in first jobs commonly judged undesirable. Still, some low scorers were to be found in desirable jobs.[43] Fifteen to thirty-five years later, men with very high scores had moved out of low status occupations, consequently widening the range of ability in high status occupations and narrowing it in low status occupations.[44] Low scoring men who had initially held

desirable positions retained them and even some low scoring men in undesirable early occupations experienced upward mobility.[45] Consequently, we suspect that the age of the samples upon which Herrnstein relied accounts, at least in part, for the pattern of his results, and we find his argument that high cognitive ability is a necessary though insufficient prerequisite for high status occupations unconvincing.

The Effects of Schooling and the I.Q. Meritocracy

In an idealized meritocracy, influences upon success other than those related to ability and knowledge are suspect. Educational attainment is viewed as a channel of ability, and the effects of education on economic success are presumed to reflect the influence of ability rather than discriminatory credentialism or other nonmeritocratic factors.

If this interpretation of the effects of schooling was warranted, we would expect to find that educational attainment depended substantially on measured cognitive ability and knowledge, and that if employers directly selected, trained, or promoted employees on the basis of their educations, they would be likely to favor only brighter or more knowledgable individuals. We might also expect to find that if success on the job depended directly on ability, that apart from initial screening early in the career, educational differences among men with equal ability would have trivial effects. None of these expectations are borne out in our data.

We have already noted that the range of educational variation among men with the same test scores is from 80 to 85 percent as large as it is among all men, and that the correlation between educational attainment and test scores is inflated by close to half because of the unmeasured influences of family background.

Employers who assume that men with the same amount of schooling are equally bright or knowledgeable are quite wrong. To be sure, high school graduates typically have higher test scores than dropouts, and college graduates typically have higher scores than high school graduates. But the overlap among the groups is substantial, and the differences within each group are large. For example, in the Kalamazoo sample the standard deviation of test scores among men with high school diplomas is 79 percent as large as among men in general, whereas among men with BA's it is 81 percent as large. The Talent values are similar.

It is true that an employer seeking very high scoring individuals would be much more likely to find them among college graduates. For example, in the Talent sample, 58 percent of the men with BA's or more had test scores greater than 110, but only 12 percent of the high school graduates had scores this high. And among men with BA's or higher degrees, only 3 percent had test scores below 90, whereas 35 percent of Talent's high school graduates scored this low. There is nevertheless a large overlap in the test scores of men who finish high school and men who finish college. In the Talent sample, 53 percent of the high school graduates and 38 percent of the college graduates have scores between 90 and 110. In the Kalamazoo sample 61 percent of the high school graduates and 49 percent of the college graduates score in this range. So, although employers may, by hiring only college graduates, insure themselves against hiring very low scoring men, they cannot rely on educational credentials to sort prospective employees precisely according to cognitive skill.[46]

Among Kalamazoo respondents, both 4 years of high school and 4 years of college are associated with a 23 point advantage on occupational status. Among men with the same test scores, the advantages are 19 points for high school, and 20 points for college. In the Talent sample, which includes almost no high school dropouts, 4 years of college is associated with a 25 point occupational advantage. Among men with the same test scores, this advantage is 21.5 points. These results mean that even when educational differences are unrelated to test score difference, they <u>are</u> related to occupational differences. This could happen if employers are concerned only with ability differences between educational groups, or if better educated men are preferable for reasons unrelated to cognitive skills. If employers were unconcerned with ability differences among men with the same amount of schooling, we would not expect measured ability to affect the earnings of men with the same amount of schooling who are in the same level of occupation. But it does. Perhaps employers are simply unaware of the heterogeneity of ability within educational groups or have no feasible means to measure it. This seems unlikely, so we suspect that better educated men make desirable employees for reasons that have little to do with their general cognitive superiority.[47]

One reason that the occupational advantages associated with more schooling persists among men with the same level of cognitive ability may be that, irrespective of test scores, education has a large effect on early occupational status, which in turn influences later occupational status. But when we examine the occupational advantages associated with more schooling among men with the same test scores and the same initial

occupational status, we find they are quite similar to the advantages among men for whom only initial occupational status is the same.[48]

Nor can the earnings advantages associated with more schooling be largely attributed to the cognitive superiority of the better-schooled, unless, of course, only average ability differences across schooling classes are of concern to employers. In both our samples, the differences in earnings associated with differences in schooling among men with the same test scores are about three-quarters as large as among men in general.[49]

The better-schooled may make better employees. They may in some rational sense merit the advantages they are accorded. Whether they do or not depends upon their relative productivity, the structural sources of productivity differences across educational groups, and the extent to which rewards should parallel contributions to the gross product. This is not the place to discuss these issues. Our one certainty is that the role of schooling in the process of individual achievement cannot be easily accounted for in terms of an IQ meritocracy.

Selection and Efficiency

For some, an attractive feature of the meritocratic ideal is that it joins the demands of justice with the needs of society. Individual entitlement and advancement redound to the benefit of all. The restriction of higher education to the more able illustrates this point. Talent earns educational provision, whereas investment in the more able raises the national product more so than would investment in the less able.[50]

No one has directly estimated the contribution of schooling to the national product,[51] but economists often assume that individuals are paid according to their marginal product, and that the private monetary benefits accruing to additional schooling index increases in productivity associated with learning (see Griliches and Mason, 1972). If the effects of schooling on earnings arise because of learning, and if the more able learn more from any given educational experience, we would expect to find that men with high test scores benefit more from additional schooling than do men with low scores. We do not.

We looked at the percentage earnings returns to increments of schooling across different ranges of ability in each of our samples, and in two other samples as well.[52] There were few significant differences within any one sample, and the patterns of observed differences were not consistent across samples. Nor was a more parsimonious test score by education interaction term significant in any of our equations when ability levels were pooled.[53]

These results suggest that either the returns to schooling reflect something other than learning, or that less able men learn at the same rate in school as more able men. In either case, rational social investment would not require the training of the more able to the exclusion of the less able.

5. CONCLUSION

We began by specifying a series of empirical propositions that are seemingly implied by the view that an IQ meritocracy governs the process of socioeconomic achievement in the United States. Heretofore, very little

data have been available with which to assess the validity of these views. Our work draws on data sources that in some ways are richer than those available in the past. Our results suggest that the I.Q. meritocracy is an article of faith, not an empirical reality.

With the exception of race, the effects of social origins in the local context have been constant for at least the last 35 years. The salience of cognitive advantages has not increased. The effects of tested ability transmit background more than they sever the ties between origins and attainments. Background exercises effects in ways largely unrelated to cognitive skills. Variations in cognitive skill contribute relatively little to variation in educational attainment, occupational status, and earnings. The effects of education on economic success appear to arise for reasons largely unrelated to cognitive skill. And the exclusion of less able students from higher education does not appear necessary for social efficiency.

We are most puzzled not by our results, but by the belief others appear to hold in the propositions we tested. When empirical propositions are widely held and advanced without substantial scholarly confirmation, their acceptability itself should become an object of interest. The logical appeal of the ideologies of equal opportunity and advancement according to merit for legitimizing the present distribution of rewards and structure of work is apparent. The attractiveness of these ideologies to individuals nourishing hopes of success for themselves or their progeny may also be assumed. However, the possible functions of ideologies are not <u>explanations</u> for the acceptance of tenets of belief, and we can go no further here than to note the problem.

We are also puzzled by the uncritical identification of measured cognitive skill with merit. Assume that our empirical results had been otherwise, and that we had found that cognitive ability had replaced family background as a determinant of adult success, that success depends largely on such ability, and that education is the most efficient possible screen for ability, and is not rewarded except insofar as it is related to ability. Such results would not answer the question of how and why cognitive ability comes to matter in the achievement process. The measurement of empirical relationships abstracted from the institutional, social, political, and economic contexts in which they arise inherently cannot account for the processes generating the relationships.[54] Without such an account, how are we to know whether a particular relationship is necessary, useful, or reasonable?

Imagine, for example, a society in which height is a determinant of success, and basketball is the major subject of the school curriculum.[55] In this society's schools, tall students are seated in front of short students, are called on in class more frequently, given more time on the practice court, and publicly recognized more often by the school newspaper. Not surprisingly, more tall students are found to be better basketball players than short students, and do better in other subjects as well. Their grades are higher, and they are consequently favored in teacher assignment and allocation of resources. The progress of tall students is closely monitored and encouraged by guidance counselors. Short students are relatively neglected, except for occasional basketball clinics and special afternoon remedial sessions. They are more likely to

quit school than tall students. Tallness, in this society, is highly valued, and parents strive to enhance their children's growth.

Such a society would no doubt feature spectacular professional basketball teams, watched and applauded by the masses. But the ability of the masses to play basketball could be only modest. One might find a decline in average basketball ability, even as the performance of professionals improved.

The point of this fantasy is not that height has no inherent bearing on basketball performance. It does, at least if the rules and style of play now prevalent continue. (If the set shot returns, the relevance of height could diminish.) But, we would argue that the observed distribution of basketball skill in our imaginary society was far more unequal than need be, and that the association between height and basketball performance is inflated by the favoritism accorded tall students. We would also argue that the overriding social importance of developing professional athletes accounted for the perception on the part of educators that basketball was a skill that could be mastered only by a few, whose ability was evidenced by early advantages in height.

The application of this analogy to schooling in our present society is uncertain. It suggests that "ability" is in some ways institutionally produced by the patterned responses accorded individual characteristics, and that these responses derive from educators' perceptions, beliefs, and expectations conditioned by external contours of social and economic structure, and that rewards for ability are in some ways arbitrary.

Data from the Talent sample allow a very crude test of this interpretation. We examined the effects of test scores on educational attainment before and after controlling variables that may proxy differential treatment of students with varying ability. Among men from similar socioeconomic origins, the standardized coefficient for test scores is 0.485. But among men from similar backgrounds who also pursued similar high school curricula, the coefficient is only 0.385. Controlling a measure of discussions with teachers regarding future educational plans does not alter this coefficient, but controlling measures of friends' educational plans and grades reduces it to 0.326. Since high school curriculum reflects choice as well as placement, since friends' plans may represent assortative friendship and not peer influence, and since grades may reflect motivation, the meaning of these results is ambiguous. But, along with results from the study of 1957 Wisconsin high school seniors, which show that controlling measures of teachers' encouragement for further education, friends' educational plans, and class rank reduces the effect of test scores net of background by 67 percent, they do suggest our interpretation may warrant attention.[56]

Bloom's recent work (1976) suggests that "slow" learners can be taught a great deal more than they usually master. His results suggest to us that students with apparently greater ability need not necessarily be favored, and that they may not "merit" any preferences shown them. On the other hand, if selective treatment of more able students is more convenient and satisfying to teachers, less costly to the public purse, and an effective and accepted way to ration limited opportunities, it is unlikely to be eliminated in the long run. These considerations suggest

that questions about the consequences of individual differences would be more usefully framed as questions about the consequences of social structure and institutional organization.

NOTES

[1]For the ties between Darwinian ideas and policies relating to the construction and application of standardized tests, see Karier, Violas, and Spring (1973), Tyack (1974), and Karier (1975).

[2]See Marks (1972) for an account of the political activities of the early testers.

[3]See especially the Walter Lippman-Lewis Terman exchange in Block and Dworkin (1976, pp. 4-44).

[4]See especially Bloom (1964).

[5]See Brody and Brody (1976) for a review of these efforts.

[6]For convenience, we will use the term IQ. We do not mean to confine the term to scores from individually administered tests. For our purposes, individual and group tests differ only in their reliabilities, if at all. Nor do we mean to extend its meaning to cover all varieties of intelligent behavior or competence. We intend only to investigate the importance of the characteristics indexed by test scores.

There is extradordinarily little available on popular beliefs about the nature or importance of intelligence. For some crude results, see Brim et al. (1969).

[7]For an overview of the role of schooling in current economic theory, see Becker (1964) and Mincer (1974).

[8]For detailed description of the Veterans sample, see Jencks (1977a); for detailed description of the Wisconsin sample, see Sewell and Hauser (1975).

[9]For example, Griliches and Mason (1972) use the Veterans sample; and Taubman and Wales (1974) use the NBER-Thorndike sample, which represents only veterans who volunteered for the Air Corps, are in the top half of the ability distribution, and graduated from high school or hold high school equivalence.

[10]Smaller, possibly even less representative samples of siblings are analysed by Chamberlain and Griliches (1975, 1977), Brittain (1977), and Corcoran, Jencks, and Olneck (1976). Sewell and Hauser (1977) plan a sibling follow-up of the Wisconsin sample, and Behrman, Taubman, and Wales (1977) analyse a very large sample of older twins.

[11]We are grateful to Dr. William Coates and Dr. David Bartz of the Kalamazoo Public School System for permitting Olneck to utilize school records, and to Dr. Stanley Robin of the Center for Sociological Research at Western Michigan University for extending the courtesies of the center to Olneck during the interviewing phase of his study.

[12]See Crouse (1977a) for details. Our measure of occupational status is the Duncan socioeconomic index (Duncan, 1961a, 1961b) which depends upon the levels of income and education characteristic of Census three-digit occupational classifications. For the preferability of this measure to measures of occupational prestige, see Duncan, Featherman, and Duncan (1972).

[13]After correcting each test for unreliability, nine tests in nonacademic subjects (Music, Art, Home Economics, Law, Health, Architecture, Photography, Theater, and Farming) had an average correlation

of 0.447, 0.389, 0.164, and 0.166 with Education, Occupation, Hourly Earnings, and Ln Hourly Earnings in our Talent Sample. The values for ten tests in academic subjects (English, Literature, Social Studies, Mathematics Information, Arithmetic Computation, Arithmetic Reasoning, Introductory Mathematics, Advanced Mathematics, Physical Sciences, and Biology) are 0.523, 0.439, 0.180, and 0.173. See Crouse (1977a) for details.

[14]The tests were Reading Comprehension, Vocabulary, Creativity, Mechanical Reasoning, Abstract Reasoning, Visualization, Table Reading, Clerical Checking, Object Inspection, Memory for Sentences, and Memory for Words.

[15]For example, the correlations between sentence memory and educational attainment, occupational status, and hourly earnings, corrected for test unreliability, are only 0.121, 0.091, and 0.051.

[16]For example, see Guilford (1967).

[17]We used academic ability measured by tests of English, Literature, Social Studies, Mathematics Information, Arithmetic Computation, Arithmetic Reasoning, Introductory Mathematics, Advanced Mathematics, Physical Science, and Biological Science; verbal ability measured by tests of English, Literature, Social Studies, Reading Comprehension, and Vocabulary; quantitative ability measured by tests of Mathematics Information, Arithmetic Computation, Arithmetic Reasoning, Introductory Mathematics, Advanced Mathematics, Physical Science, and Biological Science; and rote memory measured by tests of Memory for Sentences and Memory for Words.

[18]The academic ability principal component explained 34 percent of the variance in Education, 24 percent in Occupation, and 4 percent in Hourly Earnings. Taken together, all 30 tests explained 37 percent in Education, 27 percent in Occupation, and 5 percent in Hourly Earnings.

[19]Taken together Sentence Memory and Word Memory explain only 7 percent of the variance in the Talent respondents' grades averaged over English, history and social studies, math, science and foreign language courses.

[20]The correlation between test scores and occupational status appears stable over the career. The correlation between test scores and earnings rises with age until the mid-thirties (Fagerlind, 1975, Hauser and Daymont, 1977), so we cannot compare the Talent and Kalamazoo results on this measure.

[21]The correlations between test scores and occupational status for Kalamazoo respondents born between 1919-1923 (N=219), 1923-1928 (N=288), 1929-1933 (N=199), and 1934-1938 (N=150) are 0.342, 0.402, 0.488, and 0.491. Note that a programming error included men born in 1923 in two cohorts. This error is corrected in the results reported in Note 23 below.

[22]See Olneck (1977b) for details.

[23]In the Kalamazoo sample, the correlation between high school graduation and test scores is 0.479 for men 55 years old and over (N=121), 0.424 for 50 to 54 years old (N=303), 0.310 for 45 to 49 years olds (N=329), 0.369 among 40 to 44 years old (N=271), and 0.237 among 35 to 39 year olds (N=202). Among those who graduated from high school, the correlation between completing at least one year of college and test scores is 0.217

for men 55 and over (N=85), 0.386 for 50 to 54 year olds (N=239), 0.368 for 45 to 49 years old (N=243), 0.411 for 40 to 44 years old (N=214), and 0.484 for 35 to 39 years old (N=177). The trend toward decreasing selectivity in high school graduation and increasing selectivity in college attendance did not greatly affect the overall correlation between test scores and educational attainment. The correlation between scores and education is 0.482 for men 55 and over, 0.548 for 50 to 54 year olds, 0.465 for 45 to 49 year olds, 0.576 for 40 to 44 year olds and 0.571 for 35 to 39 year olds. Since men in the oldest cohort are more likely than others to be grade repeaters, they are likely to be less representative of their cohort than others are of theirs. Comparisons of unstandardized regression coefficients do not alter the conclusions suggested by comparisons of correlations.

[24]For Education, Initial Occupation, Current Occupation, and Ln Annual Earnings, R^2's are 0.33, 0.25, 0.16, and 0.08 for respondents under 45, and 0.21, 0.18, 0.05, and 0.05 for respondents 45 and over. If response biases or measurement are related to age, these comparisons could be misleading. Our evidence suggests that age is related to measurement error. The correlations between brothers' independent reports of father's education, father's occupation, and mother's education are 0.851, 0.854, and 0.771 respectively for pairs in which both brothers were 45 or under, and only 0.675, 0.662, and 0.692 for pairs in which both brothers were over 45 years old. Because older men come from larger families, which would increase the spread in brothers' ages, the apparent difference in the reliability of father's occupation may be inflated due to real job changes. This could not, however, explain the differences for parental education.

[25]Because our estimate of the impact of measured test scores would suggest a sibling correlation on education of only about 0.05, we doubt whether the persistence of a high sibling correlation reflects the influence of shared cognitive skills. (The estimated true standardized effect of test scores on education in the Kalamazoo data is 0.33. The correlation between brothers' test scores is 0.47. The predicted correlation between brothers' educational attainments is therefore (.33) (.47) (.33) = .05.

[26]For discussion of the persistence of black gains beyond the early 1970s, see Farley (1977).

[27]See Duncan (1966) for an explication of path analysis.

[28]Letting y_1 = Test Scores, x = Vector of Family Background variables whose values are identical for brothers, and y_2 = Outcome, we can represent the dependence of y_1 on x and y_2 on y_1 and x in matrix notation:

(1) $y_1 = \underline{a}'\underline{x} + u$

(2) $y_2 = cy_1 + \underline{b}'x + v$ with $r_{uv} = 0$

where

$\underline{a}$, $\underline{b}$ = Column vectors of coefficients for family background

$\underline{x}$ = Column vector of family background variables

c = Regression coefficient of y_1 controlling x

u, v = Disturbance terms.

Prime denotes transposition.

Substituting Eq. (1) into Eq. (2), we have:

(2b) $y_2 = c(\underline{a}'\underline{x} + u) + \underline{b}'\underline{x} + v = (c\underline{a}' + \underline{b}')\underline{x} + (v + cu)$.

Letting $(c\underline{a}' + \underline{b}') = \underline{d}'$ and $(v + cu) = w$, we have

(2c) $y_2 = \underline{d}'\underline{x} + w$.

The covariance between y_1 and y_2 is given by

$$(3)\quad \sigma_{y_1y_2} = \underline{a}'\Sigma\underline{d} + \sigma_{u,w}$$

where Σ is the variance-covariance matrix of $\underline{x}$.

We decompose the covariance between y_1 and y_2 due to family (i.e., $\underline{a}'\Sigma\underline{d}$) into two parts:

$$(4)\quad \underline{a}'\Sigma\underline{d} = \underline{a}'\Sigma(c\underline{a} + \underline{b}) = c\underline{a}'\Sigma\underline{a} + \underline{a}'\Sigma\underline{b}.$$

The covariance not due to family is

$$(5)\quad \sigma_{u,w} = \sigma_{u(v+cu)} = 0 + c\sigma^2_u.$$

The total covariance is

$$(6)\quad \sigma_{y_1y_2} = c(\underline{a}'\Sigma\underline{a} + \sigma u^2) + \underline{a}\Sigma\underline{b}.$$

Note that $\underline{a}'\Sigma\underline{a} + \sigma u^2 = \sigma_{y_1}^2$.

Thus, the covariance due to the "true" effect of y_1 on y_2 (i.e., c) may be divided into two parts, one related to family and another orthogonal to family. Since $\underline{a}'\Sigma\underline{a} + \sigma u^2 = \sigma y^2$, the proportion of that part of $\sigma_{y_1y_2}$ due to the true effect of y_1 on y_2 that is related to family is $c\underline{a}'\Sigma\underline{a}$ / $c(\underline{a}'\Sigma\underline{a} + \sigma u^2)$, or the proportion of variance in y_1 explained by family background. Thus, we say that 47 percent of the effect of test scores on early occupational status in the Kalamazoo sample "transmits" background.

Note that $\underline{a}'\Sigma\underline{b}$ in Equations (4) and (6) represents covariance due to the joint dependence of y_1 and y_2 on x_1 and corresponds to the portion of the overall correlation that we label spurious.

We are very grateful to Arthur Goldberger for time-consuming discussions on this issue, and for expressing parsimoniously what we would otherwise have expressed cumbersomely.

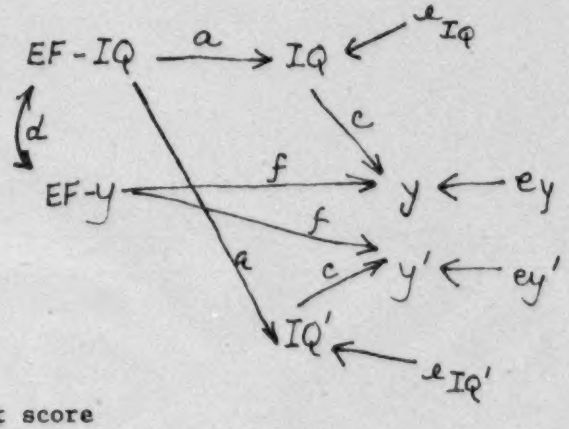
[29]Extending the logic in note 28 to distinguish family factors related to socioeconomic measures and those orthogonal to socioeconomic status, we decomposed each correlation of an outcome with test scores into components. The components represent the spurious fractions of the correlation due to the joint dependence of test scores and outcomes on background, and the non-spurious fractions associated with socioeconomic background, variations in family background within socioeconomic strata, and variations within families. The results are given below.

Correlation of Test Score With:	Sample	Within Families	Nonspurious within-SES, Between Families	SES	(beta)	Spurious within-SES, Between Families	SES	Total Correlation
(1) Education	Kalamazoo	.176	.112	.044	(.332)	.106	.139	.576
	Talent	.181	.172	.077	(.431)	.071	.131	.632
(2) Initial Occupation	Kalamazoo	.119	.076	.030	(.225)	.084	.136	.445
(3) Current Occupation	Kalamazoo	.153	.097	.038	(.288)	.095	.070	.453
	Talent	.125	.119	.053	(.297)	.080	.106	.483
(4) Earnings	Kalamazoo	.181	.115	.045	(.341)	-.027	.045	.359
	Talent	.110	.106	.048	(.264)	.073	.028	.365

[30]Under the assumption that family background no longer influenced measured ability, the variance in test scores would fall by 47 percent in the Kalamazoo sample and 58 percent in the Talent sample. Expected variances in outcome variables may be calculated as $f^2S_y^2 + b^2 (1-a^2)S_T^2 + S_{e_y}^2$, where f^2 is the square of the normalized effect of family background on y net of test scores, as in Note 31 below, S_y^2 is the observed variance in Y, b^2 is the square of the unstandardized regression coefficient of test scores controlling background, a^2 is the square of the normalized

effect of background on test scores as in Note 31 below, S_T^2 is the variance in test scores, and $S_{e_y}^2$ is the error variance in y net of background and test scores. The expected beta-which is also the expected correlation-is $b(S_T^*/S_y^*)$ where S_T^* and S_y^* are the new standard deviations of test scores and outcomes after eliminating the effects of family background on test scores. Again, we thank Arthur Goldberger for guidance through difficult terrain.

[31]Consider the class of models of the following kind (See Jencks et al., 1972; Olneck 1976a, 1977c):



where IQ = test score

IQ′ = brother's test score

Y = adult outcome

Y′ = brother's adult outcome

EF-IQ = family factors determining IQ

EF-Y = family factors determining y <u>net</u> of the effects of IQ.

In this model, $r_{y,y'} = cr_{IQ',y} + br_{y,EF-y}$

Expanding, we have

(1) $r_{y,y'} = c[ca^2 + abd] + b[b+a^2cd] = a^2c^2 + 2abcd + b^2$.

Assuming a = 0 or c = 0 leaves $r_{y,y'} = b^2$. It is this figure that ranges from 60 to 70 percent of the observed sibling correlation over all outcomes.

[32]That is, in the above model, a^2c^2 is only 15 to 25 percent of the observed sibling correlation on all outcomes.

[33]See Crouse (1977b) and Olneck (1977b), Tables 13-16, for the regression coefficients of specific background variables controlling and omitting test scores.

[34]See Brim et al. (1969) for some crude questionnaire findings.

[35]In the model in note 31, the correlation between y and IQ is (c+bda). Squaring, we have $c^2+b^2d^2a^2 + 2[abcd]$ as the proportion of variance in Y associated with IQ. But $b^2d^2a^2$ is not attributable to the causal effects of IQ. The text refers to $[1-(c^2 + 2abcd)]^{\frac{1}{2}}S_y$. Some of the variance in y is measurement error. Some may arise from factors that are essentially random from year to year. If this "unstable variance" could be removed, one could estimate the percentage of stable variance in men's occupation and earnings explained by test scores. This might lower the values given in the text. But we doubt that our substantive conclusion would change.

[36]We controlled measures of father's education, father's occupation, and number of siblings. Controlling additional measures such as foreign birth, family composition, and mother's education does not significantly alter our results.

[37]If this is the case, the within-family coefficient is not necessarily a more exact estimate of the "true" effect of a variable than is the uncontrolled coefficient. The interpretation of the within-family coefficient as less biased than the uncontrolled coefficient is valid only if the two differ solely because of the biasing effects of omitted variables. Jencks and Brown (1977) recognize that this may not be the case for the genetic and environmental determinants of IQ.

[38]In this connection, the current follow-up of Wisconsin sample siblings (Sewell and Hauser, 1977), which will produce 750 male-male pairs, is of major interest. No results are available at this time.

[39]About half the nonspurious effects of cognitive ability on occupational status are mediated by the intervening effects of education. This is also true for earnings in the Talent sample, but not in the Kalamazoo sample. Nor are the effects of test scores on earnings in the Kalamazoo sample reduced substantially when measures of adolescent personality based on teachers ratings of students' characteristics are controlled (Olneck, 1976a).

[40]Grouping current occupations by the Census major classifications, we have the following means, standard deviations, minimums, and maximums for test scores.

Occupational Group*	Mean	Standard Deviation	Low	High	N
(1) Professional, technical and kindred	107.3	16.9	62	150	215
(2) Managerial, administrative, and proprietors (except farm)	104.4	14.0	72	159	308
(3) Sales	104.4	14.4	73	135	78
(4) Clerical and kindred	100.8	13.2	73	143	62
(5) Craftsmen and kindred	96.8	13.6	65	134	321
(6) Operatives (except transportation)	91.7	12.4	62	120	117
(7) Transportation operatives	87.2	12.8	59	116	53
(8) Nonfarm laborer	93.0	9.0	78	111	19
(9) Farmers, farm foremen and managers, farm laborers	90.3	9.8	79	103	4
(10) Service (except private household)	90.4	13.2	67	131	40

*We have followed Census groupings, which parallel Duncan status scores. Herrnstein groups occupations by median test scores. He reports that average test score and the social standing of an occupation correlate 0.70 (Herrnstein, p. 124).

[41]Grouping current occupations by the Census major classifications, we have the following distributions of test scores.

Occupational Group	Percent: Less than or Equal to 85	86-100	101-115	116-129	Greater than or equal to 130	N
(1) Professional, technical and kindred	10	21	40	21	8	215
(2) Managerial, administrative and proprietors (except farm)	8	34	39	16	3	308
(3) Sales	12	27	41	15	5	78
(4) Clerical and kindred	11	39	39	8	3	62
(5) Craftsmen and kindred	21	39	29	10	1	321
(6) Operatives (except transportation)	33	41	21	4	0	117
(7) Transportation operatives	49	34	15	2	0	53
(8) Nonfarm laborer	32	53	16	0	0	19
(9) Farmers, farm foremen and managers, farm laborers	25	50	25	0	0	4
(10) Service (except private household)	45	38	13	3	3	40
Total Percentage:	18	34	33	12	3	N=1217

[42]Grouping test scores by standard deviation intervals, we have the following means and standard deviations for current occupational status (Duncan scores).

Test Score	Mean	Standard Deviation	N (Total Survey)*
70 and below	28.2	17.6	18
71 - 85	35.9	21.4	204
86 - 100	45.2	22.1	424
101 - 115	55.3	21.1	401
116 - 130	61.5	20.5	152
Over 130	67.7	20.9	38

*Sums to 1,237. Only 1,220 reported occupation.

[43]Grouping initial occupations by the Census major classifications we have the following means, standard deviations, minimums and maximums for test scores.

Occupational Group	Mean	Standard Deviation	Low	High	N
(1) Professional, technical and kindred	111.5	15.9	72	159	213
(2) Managerial, administrative and proprietors (except farm)	105.7	13.5	74	141	69
(3) Sales	103.4	13.4	73	137	76
(4) Clerical and kindred	101.3	12.2	73	134	127
(5) Craftsmen and kindred	96.8	14.2	63	142	257
(6) Operatives (except transportation)	95.8	13.8	64	130	238
(7) Transportation operatives	94.8	13.9	59	131	73
(8) Nonfarm laborer	94.2	14.5	67	130	88
(9) Farmers, farm foreman and managers, farm laborers	90.8	11.4	62	104	13
(10) Service (except private household)	92.8	13.2	69	128	50

Grouping initial occupations by the Census major classifications, we have the following distributions of test scores.

Occupational Group	Percent: Less than or equal to 85	86-100	101-115	116-129	Greater than or equal to 130	N
(1) Professional, technical and kindred	3	23	36	26	12	213
(2) Managerial, administrative, and proprietors (except farm)	6	30	44	16	4	69
(3) Sales	11	32	42	12	4	76
(4) Clerical and kindred	10	36	42	11	1	127
(5) Craftsmen and kindred	22	36	32	9	2	257
(6) Operatives (except transportation)	25	37	28	10	0	238
(7) Transportation operatives	22	43	30	4	1	73
(8) Nonfarm laborer	36	35	18	10	0	88
(9) Farmers, farm foremen and managers, farm laborers	23	54	23	0	0	13
10) Service (except private household)	36	34	26	4	0	50
Total Percentage:	18	34	33	12	3	1204

[44]Compare Note 43 to Notes 40 and 41.

[45]Comparing early occupations to current occupations for men with scores of 85 or below we have the following results.

Number in Current Occupational Group

Early Occupational Group	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	N
(1) Professional, technical and kindred	4	2	0	0	0	0	0	0	0	0	6
(2) Managerial, administrative, and proprietors (except farm)	0	3	0	0	0	1	0	0	0	0	4
(3) Sales	1	1	5	0	1	0	0	0	0	0	8
(4) Clerical and kindred	2	1	0	2	2	3	1	0	0	2	13
(5) Craftsmen and kindred	6	6	3	2	26	7	3	0	0	4	57
(6) Operatives (except transportation)	2	4	1	0	20	19	3	1	0	7	57
(7) Transportation operatives	2	2	0	0	0	2	9	0	0	1	16
(8) Nonfarm laborer	1	3	0	1	10	6	4	4	0	2	31
(9) Farmers, farm foremen and managers, farm laborers	1	0	0	1	0	0	0	0	1	0	3
(10) Service (except private household)	2	0	0	1	6	1	5	1	0	2	18

[46]Grouping individuals by education, we have the following test score distribution.

Education	N	Mean Test Score	Standard Deviation	Percentage of Respondents in Each Test Score Interval < 90	90-110	>110
Talent:						
H.S. graduates	327	94.8	12.9	35	53	12
College graduates	113	109.4	11.1	7	41	52
Education beyond college	202	106.5	10.3	1	37	62
Kalamazoo:						
H.S. graduates	496	97.3	12.0	27	60	13
College graduates	143	111.0	12.4	4	46	50
Beyond college	127	115.02	15.2	2	39	59

The numbers in the text combine college graduation and men with education beyond college.

[47]Results from the Michigan Panel Study of Income Dynamics data and the NORC Veterans data are in general agreement with our results here. The Veterans data do, however, show a 40 percent reduction in the effects of secondary schooling on occupational status when test scores are controlled. See Olneck, 1977a.

[48]In the Kalamazoo data, a 1 year increment in schooling is associated with a 5.0 point increase in current occupational status. Among men whose first jobs are equivalent in status, an extra year of schooling is associated with a 3.3 point advantage on current occupation. This is only reduced by 16%, to 2.75 points when test scores are controlled.

[49]For detailed analyses of biases in the schooling-earnings relationship in these and other samples, see Olneck (1977a).

[50]The less able do not continue in their schooling for reasons of choice as well as exclusion. Indeed, economists often assume on theoretical grounds that the less able leave school because it profers them a lower rate of return than it does the more able. See, for example, Renshaw (1960), Becker and Chiswick (1966), and Weisbrod and Karpoff (1968).

[51]For attempts to indirectly estimate the contribtuion of increased schooling levels to national growth, see Denison (1962, 1964).

[52]The other samples were the Michigan Panel Study of Income Dynamics and the NORC Veterans sample. See Olneck (1977a).

[53]Nor do other data support the claim of an ability-education interaction. The effects of measured ability show inconsistent and insignificant differences across schooling levels in the NBER-Thorndike, Roger's,

Talent 5-year Follow-up, and Husen samples analyzed by Hause (1972). Hause interpreted his findings as demonstrating an ability-schooling interaction, but his data do not support the conclusion. Hauser and Daymont (1977) find no such interaction in the Wisconsin follow-up data, and Griliches (1977) reports the absence of such an interaction in the National Longitudinal Survey data.

[54]For criticism of the acontextual analysis of empirical relationships, see Michelson (1973).

[55]See Bane (1975) and Bane and Crouse (1975) for further elaboration of this analogy.

[56]For these data, see Sewell and Hauser (1975). Hauser, Sewell, and Alwin (1976, p. 329) show that class rank and course of study alone reduce the within-school effect of test scores on educational attainment by 78 percent.

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